principal morbid changes which they detected in the numerous dissections of leprous patients made by them in the hospital at Bergen.

Tubercular form.—In the developed stage, the cutis vera of affected parts tumefied and thickened. When squeezed between the fingers a yellowish white, viscid or gristly fluid exudes. Subcutaneons cellular tissue, infiltrated with a gelatinous or lardaceous effusion, firmly adherent to corion. Subcutaneous veins and nerves thickened and enlarged from the same effusion on their outer surface. In the advanced stage both the deep-seated and superficial nerves, especially in the neighbourhood of ulcerations, very much thickened and enlarged, in consequence of inflammation of their sheaths. Mucous membrane of nares, fauces, and larynx swollen, occupied with tubercles, soft, yellowish in colour, and often ulcerated. The opening of larynx frequently the seat of morbid deposit, nearly closing up, sometimes, the *rima glottidis.* Tubercles occasionally occur on mucous lining of trachea and larger bronchi. Cervical glands, in some cases, much enlarged. Substance of lungs seldom altered; pleura often much thickened from tuberculous deposits in its cellular tissue. A similar condition may occur in the subperitoneal cellular tissue. On the inner surface of intestines, isolated, rounded ulcers are occasionally present. Mesenteric glands generally more or less enlarged. Liver sometimes the seat of tubercles. In the advanced stage of the disease kidneys almost always more or less seriously affected, usually with the results of albuminous nephritis present. Within the cerebral and spinal cavities no distinct or uniform morbid changes are detected.

Asthenic form.—When completely developed, with decided paralysis of muscles and skin, the latter is often much attenuated—all the fatty matter gone. Substance of muscles atrophied; cellular tissue surrounding seat of ulceration or necrosis, infiltrated with a serous or lardaceous deposit. The nerves traversing the infiltrated tissue, and those deeper seated excessively swollen, their sheaths filled with a firm albuminous matter in which the ultimate nervous filaments are imbedded; alterations precisely the same as those found in the tuberculous form of the disease, and supposed to be the result of inflammation of the nerves. The axillary and inguinal glands are, at the same time, often much enlarged. The lesions of the nervous centres, which are present in most cases, are chiefly congestion of the posterior or dorsal veins of spinal marrow, effusion of an albuminous serum within arachnoid membrane and the dura mater; adhesion of arachnoid membrane to pia mater; consolidation or hardening of substance of spinal cord at part affected. Cord usually somewhat contracted in size; so atrophied, sometimes, as not to be larger in diameter than a quill. The cineritious substance has acquired a dirty yellow colour, resembling a good deal the medullary substance. The roots of the nerves within the spinal canal invested with albuminous exudation. Sometimes the axillary and ischiatic plexuses, and the principal nerves issuing from them, are visibly atrophied. The above changes are always most conspicuous in the cervical and lumbar portions of the cord. Within the cranial cavity the same changes occur as in the spinal, but in a far less decided or advanced degree. Whenever well-marked facial anæsthesia has been present, the Casserian ganglion has been found the seat of some change. The most marked morbid change in the condition of the blood of leprous patients is an excessive amount of albumen and fibrin. The same sanguineous dyscrasia is found in both forms of leprous disease, the tuberculous and anæsthetic.

D. F. C.

ART. XXI.—*On the Physiological Action of the Calabar Bean (Physostigma Venenosum, Balfour).* By THOMAS R. FRASER, M. D., Assistant to the Professor of Materia Medica in the University of Edinburgh. From the Transactions of the Royal Society of Edinburgh. Vol. XXIV. Quarto. pp. 73. Edinburgh, 1867.

THE Calabar Bean, though known as a judicial poison of the negroes of the west coast of Africa, did not attract attention on the part of the medical public until the discovery of its power of contracting the pupil of the eye. In 1855 Dr. Christison, in a paper published in the proceedings of the Royal Society of Edinburgh, directed the attention of physiologists to some of its remarkable properties. Since then it has been experimented with by ophthalmic surgeons, and numerous notices will be met with in the journals. The last edition of the *British Pharmacopœia*, recently published, contains this substance in the list of officinal articles of the Materia Medica.

The paper now under consideration contains the results of Dr. Fraser's experiments to determine the mode of operating upon the animal system possessed by this remarkably energetic poison. In presenting this account of his investigations, the author does not conceive that they are exhaustive, and states that "the effects which follow the topical application to the eyeball will be merely alluded to in this paper, as this portion of the subject has not been completed. Enough has, however, been done to convince me of the insufficiency of the views hitherto advanced, and to suggest the advisability of extending my observations."

In 1863, Dr. Fraser obtained from the kernel and the spermoderm of the bean a peculiar principle, having the peculiarities of an alkaloid, and with it a crystalline acid resembling tartaric. To the principle he gave the name of *Eseriniă*, derived from the word *Eserĕ*, by which the bean is known in Calabar. In his experiments, the alcoholic extract was employed. As this extract contains some oil, and as it is also hygroscopic, in conducting the experiments, the quantity was definitely weighed from such as was kept in an exsiccator. The experiments were made upon frogs, birds, and animals, and it was "found that fatal results were produced with the smallest quantity on birds; and that the largest doses in proportion to weight, were required by amphibia." A dose of $\frac{1}{16}$ of a grain proved rapidly fatal to a pigeon, while a frog bore three grains of the extract and recovered. In his previous paper of 1863, published in the *Edinburgh Medical Journal*, Dr. Fraser showed that the more rapid the absorption of the poison, the more quickly are its fatal effects produced, and that the active principle may be absorbed by any living tissue. From digestion in the gastric juice there does not appear to be a loss of effect in the active principle of this bean; thus, after having been digested for twenty-four hours in the gastric juice of the dog and purified, it produced contraction of the pupil, when applied to the conjunctiva. There is another fact presented in connection with the stomach which is interesting. When injected into the jugular vein of a dog to the extent of five grains and the stomach immediately removed after death, the contents, with the scrapings of the mucous coat, were properly treated and reduced to the state of extract. A minute portion of this produced contraction of the pupil. This is in accordance with the statements of Dr. Brinton and Dr. Taylor with respect to the excretion of poisonous substances.

The following phenomena are presented when poisonous doses of physostigma are given to mammals: "When a small fatal dose is administered to one of the lower animals, a train of symptoms is produced usually in the following order: A slight tremour is first seen, especially at the posterior regions, and this extends forwards to the anterior extremities and to the head. The limbs yield immediately afterwards, the posterior becoming generally first paralyzed, and the animal lies extended in a state of almost complete muscular flaccidity. A few attempts may be made to recover the normal position, but they are usually ineffectual. The bowels in most cases are evacuated and urine is passed. The pupils generally *contract;* as the symptoms advance, the respiration becomes slow and irregular, with a distinct stertor accompanying both inspiration and expiration, and frothy mucus escapes from the mouth. Muscular twitches occur and often continue after respiration has ceased. Reflex action cannot be produced by either pinching or pricking the skin. By and bye the eyelids do not contract when touched or even when the eyeball is pushed. On lifting by the ears, the limbs hang quietly, and the only sign of life is an occasional gasping inspiration, which also soon ceases, and the animal appears dead."

Consciousness is preserved during the whole time, until the power of expression is lost. During incomplete paralysis, proofs of sensation may be obtained by pinching the ears or pricking the skin. Immediately after death the pupils dilate.

On opening the body, the various muscles which are cut contract. The diaphragm and muscles of the extremities may be excited to action by pinching the phrenic and sciatic nerves, and the contractility of the muscles generally is retained for some time after death. The heart is found acting regularly and the intestines exhibit vermicular action. The heart may continue its action for one hour and a half after death. Its chambers usually cease to contract in a definite order, the left auricle first losing its spontaneous action, then the right and left ventricles, and after an interval the right auricle. The large veins in the thorax are found distended. The lungs are engorged—in two experiments this proceeded to such an extent that detached portions sunk in water.

When a large fatal dose of the kernel is administered, the hind limbs almost immediately yield and the animal falls. It lies flaccid and in any position on the table, and exhibits muscular power only by a few twitches. The pupils contract; in a few cases fluid escapes from the nostrils and mouth, and the lachrymal secretion is increased. Reflex action cannot be produced by irritation, and the respiration, after a few gasps, ceases.

The pupils dilate immediately after death. On opening the body, muscular twitches occur. The heart is found distended and passive; irritation, however, produces contraction for about ten minutes after death. The vermicular action of the intestines is very much diminished, and can scarcely be observed.

The mesenteric arteries and veins may be readily distinguished by the colour of their contents.

Phenomena similar to the above were observed in the cold-blooded animals, as frogs.

From the exposition given of the effects of the physostigma, the evidence is presented that it is a decided paralyzer, and it becomes an interesting inquiry wherein consists its especial potency, or on what structures is its force expended. The several points involved in this investigation are taken up separately by the author, and—

1st. *The Action on the Voluntary Muscles.*—"A full-grown rabbit had injected into the subcutaneous tissues of its flank three grains of extract in water. Tremours occurred in two minutes, the anterior members soon yielded, and in four minutes and thirty seconds the animal fell, the muscular trembling having increased in vigour, and having become general over the body. Respiration ceased in five minutes after the injection, but muscular tremours continued during other three minutes. When the thorax was opened, the heart was found dilated and passive. In twenty-four minutes galvanic stimulation of the sciatic nerves caused powerful muscular contractions; within thirty-six minutes, these nerves were completely paralyzed, though application to the voluntary muscles of the electropodes produced marked contractions. Though weaker and weaker, these contractions continued for an hour and thirteen minutes after the administration of the poison. The general result with warm-blooded animals was the same; muscular contractility remained after the destruction of the function of motor nerves; and this also occurred with the frog." The experiment proved the absence of any paralyzing effect through the blood or striped muscles.

Rigor mortis is delayed for an unusual period after apparent death in cold-blooded animals, and in mammals and birds is not hastened. In both classes this change in the condition of the muscles is only indirectly affected by this substance and through the influence on the cardiac contractions. When the blood supply of the muscles is stopped their function is suspended and rigidity follows, but the resulting rigor does not seem to be due in any other than this indirect method to the action of physostigma. The above statement is shown by the following experiment: "The right iliac artery of a frog was tied, the poison was then introduced into the skin of the shoulder. In a few minutes general paralysis existed, and the skin of the tied limb was paler. In an hour and twenty minutes, the sciatic nerves being exposed, it was found that the left was completely paralyzed, while galvanism applied to the right nerve, or that of the protected limb, produced active muscular contractions. The muscles of the tied limb were pale as contrasted with those to which the poison had access, and the latter were distinctly blue in colour. The non-poisoned muscles continued active until forty hours, and at forty-nine hours they were acid and stiff and did not contract when galvanized. In the poisoned parts the functions of the motor nerves were destroyed in three hours and ten minutes, the non-poisoned or right sciatic continued active until thirty-two hours. It was possible to distinguish the heart's impulse on the thoracic walls and to determine the frequency of its contractions, and at the end of three days fifteen feeble beats per minute were occurring. The circulation was maintained for eighty hours as demonstrated by the microscope." During all this period the muscles were everywhere, except in the tied limb, flaccid, blue, and of alkaline reaction and contracted, though latterly with diminished vigour, when galvanized; those of the tied limb were now putrefying. In one hundred hours the poisoned muscles had lost much of their blue colour and contracted slowly and partially. In one hundred and twenty hours they were slightly stiff, and galvanism produced merely a slow surface depression at each electrode. Such contraction could still be obtained more than five days after the injection of the Calabar. A similar dimpling could be produced on the heart long after it had lost its power of spontaneous contraction.

From his experiments, the author's conclusion is in opposition to that of Mr. Nunneley, that the poison produces paralysis of the striped muscles, for it appears that ideo-muscular irritability is the last vital property to disappear in death by Calabar bean. Its loss is only caused indirectly, as this is due to the cessation of blood supply which is necessary for its manifestation.

In the experiments with mammals and birds an early and constant symptom was the occurrence of successive muscular contractions of a non-coördinate character. This varied in accordance with the rapid or slow introduction of the substance; in some cases it was so strong that the animal appeared as if under the action of a tetanic. The twitches became more marked when the poisonous effects were fully developed; they gradually diminished in strength as death approached, and continued in a slight form for many minutes after it. Exposure of muscles to the air and irritation with a knife, during autopsy, increased the strength of their contractions, and even originated them in muscles and parts of muscles from which they had disappeared, and it was then observed that the whole of a muscle seldom twitched at once, but portions of it separately in succession. When a muscle was removed from the dead body these twitches were continued.

2d. *Action on the Cerebrum.*—So far as paralysis is concerned, it is not produced by any action on the cerebrum.

3d. *Action on the Motor or Efferent Nerves.*—In experiments frequently repeated, it was found that the motor nerves were not paralyzed before the respiratory movements had ceased, although it occurred that the motor nerves were paralyzed immediately after the cessation of respiration. The interval during which they remain active varies greatly in different animals and in the same animal according to the dose of the poison; in the latter case, as thought by the author, in an inverse ratio. From experiment, Dr. Fraser differs from Harley that physostigma is a respiratory poison only, and that the early production of asphyxia is caused by paralysis of the motor nerves. These nerves were directly amenable to galvanic influence, although no reflex action could be produced. The excitability of the motor nerves is, however, ultimately lost from the influence of the poison, as shown by protecting the sciatic nerve by ligature of the vessels on one side—when its conductivity was continued five hours—in a frog, longer than that of the opposite limb into which the poison had penetrated. In losing the motor conductivity, the question arises with respect to the destructive impression on the trunk of the nerve or on its "end organs (peripheral terminations). To determine this, the following experiment was performed:—

"Immediately after the left ischiatic artery and vein were tied, two grains of the extract were placed in the back of a frog. Before twenty minutes respiratory movements had ceased, while the heart was beating rhythmically at the rate of thirty beats per minute. One hour after the administration of the poison, the right (or poisoned) sciatic nerve was exposed and found active, but in other twenty minutes strong galvanism applied to any portion of its trunk could not produce contractions in the muscles to which it was distributed, and an examination of the brachial nerves proved them also to be paralyzed. The left sciatic nerve was, however, perfectly active. When it was galvanized, movements confined to that limb were produced in the muscles below or distant from the ligatures. *These ligatures were on the thigh; but stimulation of the nerve above them, or of the lumbar nerves of the same side, was followed by energetic muscular contractions below the points of the ligature.*"

A further experiment was made by isolating the gastrocnemius muscle and cutting off its circulation, retaining its nerve connections; when it retained its power of contracting after it was lost in the other muscles of the same leg and of the animal which were not protected.

From these the conclusion is that physostigma produces paralysis of the peripheral extremities of the motor nerves, and in this respect it is in the same category of substances as curara experimented with by Bernard, and conia experimented with by Kölliker. It is remarked, however, by the author that the peculiarity of the Calabar is in the necessity of prolonged contact with the nerve terminations, and a long continued circulation of the poison-bearing blood.

While the effect of the poison is to destroy nerve excitability or conductivity at the termination of the nerves, which is retained for a long time when the poison is excluded, the effect on ideo-muscular contractility is exactly converse, that property being uninjured by the mere presence of physostigma, but diminished and destroyed by stoppage of the circulation. From the experiment to determine another point, *i. e.*, the progression of the paralysis, it cannot be concluded that the motor nerves are paralyzed by a centripetal progression of the poison.

4th. *Action on the Afferent Nerves.*—The excitability of these nerves appears not to be affected so long as the spinal cord retains its diastaltic power. Instead of their excitability being diminished, it would appear to be actually increased. Here is another point of resemblance to curara.

5th. *Action on the Spinal Cord.*—From the detail of the foregoing experiment, it is clear that the paralysis with which animals are immediately stricken on administration of Calabar bean is not due to the effect upon the brain, or the muscles, or the nerves. By this process of exclusion there is no other seat of injury to be sought for but the spinal column. The following experiment is to the point.

"A grain and a half of the extract in fifteen minims of distilled water was injected into the abdomen of a small dog. The animal sustained the paralytic shock, and in eleven minutes all respiratory movement had ceased. The spinal cord was immediately exposed, and the strongest galvanism consistent with the localization of the current, applied to various portions of its substance, failed to excite any movements of the body. A sciatic nerve was then exposed, and slight stimulation of it produced vigorous contractions of the limb, but no reflex movements. The heart continued to beat." A variation of the experiment was performed on a frog, in which the left femoral artery and vein were tied, the poison introduced into the back. No reflex action of the limbs could be produced, and yet the galvanic stimulus was manifested in both the poisoned and unpoisoned nerves. These experiments were considered decisive, "for the diastaltic function of the spinal cord was completely destroyed, while the poisoned and non-poisoned motor nerves were in so equally active a condition, that the difference between the times in which impressions travelled along two portions of the same nerve, differing in length by one inch and a half, could not be measured in either, even by a delicate instrument specially adapted for this purpose." The effect of the Calabar bean would appear to be antagonistic to that of strychnia. This was determined by experiment. For when a frog was brought into a convulsive state by strychnia, the Calabar tetanic manifestations soon disappeared, and when poisoned by Calabar the strychnia did not produce convulsions. It is the opinion of the author that no other drug so directly diminishes reflex action, and is, therefore, so likely to be employed with advantage in tetanus as physostigma. The poison is considered to be a spinal paralyzer.

6th. *Action on the Heart.*—With a large dose, the animal dies by cardiac syncope; with a smaller one, the heart beats are only diminished in frequency, and, as the circulation continues, the spinal cord is more and more affected, until its diastaltic function is destroyed and asphyxia caused. From carefully conducted experiments with respect to the reduction of activity in the heart's movements, the following summary may be presented: "1st. Diminution never preceded by increase of the contractions, with prolongation of the period of rest; 2d. Feebleness of the contractions, with no change of colour on the occurrence of systole; 3d. Irregularity of rhythm, the auricles contracting more frequently than the ventricles, and, for intervals, contracting alone; 4th. Stoppage of all the heart's chambers. If the poison be absorbed quickly and in large quantity, the fifth and sixth effects may not occur. 5th. Renewal of contractions, either by all the chambers at once, or by one or more in the first place; 6th. Gradual recovery to a low rate of action, and continuance at this from a few minutes to several days; 7th. Stoppage in diastole of spontaneous contractions; and 8th. Loss of the idio-muscular irritability of the heart, rigor, and change of reaction from alkaline to acid." The method of affecting the heart distinguishes this poison from antiaris, tanghin, digitalis, black hellebore, and the nereum oleander, which produce first irregularity and acceleration of the heart's action, then a diminished frequency caused by protraction of the ventricular systole, and finally stoppage of the contractions by cessation of the dilatation of the ventricles, which then remain contracted, white, and perfectly empty. In producing cardiac paralysis, physostigma acts in a manner exactly the reverse. It causes no acceleration, it diminishes the frequency of the contractions by prolonging the ventricular diastole, and produces the final stoppage by cessation of the contraction of the ventricles, which themselves remain dilated, dark, and full of blood.

The mechanism of the impression resolves itself into the influences of the cerebro-spinal nervous system, whether exerted through the vagi or the spinal nerves, or the possible influences of the sympathetic system, whether exerted through the great sympathetic trunks and their branches or through the ganglia contained in the heart's substance. Any effect on idio-muscular contractility has been disproved, but it will be necessary to observe how far the impairment and cessation of respiration may explain the cardiac effects in warm-blooded animals.

The paralysis of the heart in diastole, and the diminution in the frequency of its contractions by protracted periods of rest in a dilated condition, as well as the frequent renewal of its action after a long pause in diastole, might in the first place suggest that the inhibitory function of the vagi was being exerted. To determine this the following experiment was performed. "The heart and two vagi nerves in a frog were exposed; by galvanizing either of the nerves, stoppage of the heart's action occurred in diastole. The contractions of the heart were found to be 58 per minute. The extract (3 grs.) dissolved in a few drops of water was then injected into the two thighs, in equal proportions. In 10 minutes, the heart beating 36, galvanism of the left vagus produced stoppage in diastole. In 1 hr. 5 m. galvanism produced stoppage in all the chambers. In 1 h. 50 m. galvanism of the left vagus produced stoppage of all the chambers, and the heart remained at rest in diastole for ten minutes, when a feeble auricular contraction occurred, and soon after a ventricular; galvanism of either sciatic nerve caused merely faint twitches of the toes. In 2 h. 10 m. cardiac contractions, 18 per min., feeble but rhythmical. Strong and continued galvanism of the left vagus produced no effect on the contractions; this was also the case with the right vagus; the reflex action from the feet was lost; and at 2 h. 40 m. the heart stopped." From this experiment it is apparent that the vagi retain their inhibitory power over the heart during the whole period that its action is being modified by physostigma. Ultimately, however, they are themselves paralyzed, as might be anticipated from the analogies that exist between them and the spinal nerves, and the functions of the vagi and the spinal nerves are lost simultaneously, or nearly so. It is, therefore, quite possible, as far at least as conveyance by the vagi nerves is concerned, for Calabar bean to act on the heart by exciting the cardiac inhibitory centre in the medulla oblongata. But if this be the method of its action, the prevention of this possible influence by division or previous paralysis of the vagi, or by destruction of the medulla oblongata, should render it impossible for Calabar bean to produce its usual effect upon the heart.

To determine the above, the following experiments were performed: "The heart and the two vagi nerves of a frog were exposed, and the latter divided, and in a few minutes the cardiac contractions were found to be 66 per minute. Two grains of extract were then injected into each thigh. In two minutes cardiac contractions were 60 per minute; in forty-two minutes, after being reduced to nine beats, the heart stopped in diastole for thirty-five seconds." It continued to contract very irregularly for many hours afterwards. These experiments are deemed sufficiently conclusive that it is not upon the vagi that the effects are produced which lower and ultimately destroy the contractility of the heart; and the same facts are deduced from experiment upon the spinal centres.

To complete the evidence, it is shown by experiment that no connection of cause and effect necessarily exists between the impaired respiratory movements and the cardiac paralysis. Thus, in a dog, in one minute and thirty seconds after the poison was administered, the number of cardiac contractions had fallen to less than one-half, while the respiratory movements had increased by one per minute. It shows distinctly the absence of any respiratory change to cause the marked effects that were produced on the heart's action. As the arrest of the respiratory movements goes on, the action of the poison on the heart is assisted by impeding the circulation.

From the investigations thus set forth, it is the opinion of Dr. Fraser that the cardiac action of physostigma is quite independent of the cerebro-spinal nervous system, and is not a mere effect of the paralysis of respiration. It must, therefore, be caused by an action of a direct nature on the cardiac ganglia, which seem to be the only constant exciters of this organ, however its contractions may be regulated by other nerves. The peculiar changes that the heart's action undergoes, the diminution in the frequency of the beats, then their stoppage or irregularity, sometimes followed by renewal of the rhythmical contractions, or of independent movements in all the chambers or in one only, prove that Calabar bean first diminishes the vitality of the exciting ganglia, and then paralyzes them. It resembles digitaline and the extract of oleander.

7th. *Action on the Bloodvessels.* 1st. *Effect on Blood Tension.*—The results of experiments conducted for the purpose of determining this point were the following: During the first stage of poisoning, the arterial tension diminishes slightly, the venous tension arrives at a higher maximum rather later and by more gradual stages than the arterial, and in the same gradual manner declines until death. In neither system is the highest point reached before a very considerable fall has been caused in the frequency of the heart's contractions. The temperature rises during the poisoning, and attains its maximum near the time that the blood pressures have commenced finally to diminish.

By experiment, it was shown that the same effects are produced on the circulation, after the division of the vagi, as when these inhibitory nerves retain their connection with the heart. The action on the frequency of the heart's beats is well illustrated in this experiment, from their number having been considerably increased, before the exhibition of the poison, by the division of the vagi nerves.

The distance over which the mercury travels in the oscillating column seems to be increased as the effects of the poison manifest themselves. This appears from all the experiments in this series, but especially from the second and the last. The division of the vagi in the last experiment had abnormally diminished the distance of oscillation; and yet it became much greater after the poisoning than it had been previous to the nerve division. It further appears that this increase in the oscillating distance occurs when the arterial tension is about its maximum. It can only be explained by a very decided increase in the force of the cardiac contractions. Dr. Fraser believes that this effect on the heart is altogether a reflex one, due to the resistance to the propulsion of the blood that the augmentation in the general vascular tension must excite. In a normal condition, a stimulus of this nature might be expected to operate by increasing the *number* and not the *strength* of the cardiac contractions, but any tendency to increased frequency is opposed by the action of physostigma, for we have already seen that this substance diminishes the number of the contractions by prolonging the diastolic pause. Their strength may, however, continue unchanged, and during the operation of physostigma a stimulus may even increase it without affecting the number of beats, so long as the ganglia that initiate the systolic contraction have their excitability merely lowered without being destroyed, and the contractile power of the cardiac muscle continues undiminished.

2d. *Examination of the Calibre Changes in the Smaller Bloodvessels.*—The action of Calabar bean on the minute bloodvessels of the frog's web is to contract them considerably first, and then dilate them. This is attributed to a specific effect on the ganglia and nerves that govern the calibre changes of the vascular system, because it is by their influence that the final dilatation must be produced.

In explaining the changes of blood tension in mammalians, Dr. Fraser believes that the slight fall that usually occurs in the mean pressure immediately after the poison has been exhibited is solely due to the diminution in the rate of the heart's contractions which has always been caused by that time. The subsequent rise in both arterial and venous tensions, before any considerable embarrassment of the respiration, may be satisfactorily explained by such contraction of the smaller arteries as has been demonstrated to occur in the vessels of the frog's web. It cannot be caused by increased cardiac pressure; for the heart is at the same time contracting with only one-half of its normal rapidity, or with even less, while the greater force of each heart beat the increasing oscillating distances appear to indicate is quite insufficient to account for the high degree of blood tension sometimes attained. The subsequent more or less rapid diminution of pressure in both arterial and venous systems is the evident result of the great dilatation in the minute bloodvessels, assisted by the weakening of the *vis a tergo* that this poison quickly produces.

The *elevation of temperature* in mammals poisoned by Calabar bean is inconsiderable; this is attributed to the general muscular contractions.

Action on the Blood.—The blood obtained from animals that have been poisoned by Calabar bean is generally dark in colour, because of the usual cause of death, but if drawn from the left side of the heart after a very large dose of the poison, it has the scarlet hue of arterial blood. It frequently remains semi-fluid for some time, and then clots loosely. In dogs and rabbits the red blood corpuscles are changed in form and present various irregularities of outline, among which a well-marked stellar crenation preponderates. No change is produced in the red corpuscles of birds or frogs, or in the white corpuscles of any animal. The respiratory function of the blood did not appear to be interfered with.

In twenty-one minutes the lymphatic hearts of the frog ceased to beat after the injection of the poison.

The effect upon the peristaltic movement of the viscera is similar to that on the capillary vessels. For some time the intestines move with increased vigour; they then contract so as very considerably to diminish their calibre, and finally they assume a condition of dilatation with lessened movement.

The marked effect which attracted attention to the Calabar bean is contraction of the pupil. Discussion is still exercised in explaining the contraction and dilatation of this structure. Without pretending to settle this question, Dr. Fraser, from his experiments, accedes to the belief that the cause of pupillary contraction during poisoning by internal administration is in all probability to be found among those consequences that naturally succeed the removal of the influence of the cervical sympathetic nerve, but irrespective of paralysis of the radiating fibres of the iris, is disposed to attribute something to the static condition of the bloodvessels of the eye.

With respect to the effects when topically applied to the nerve centres or nerves, when absorbed, the same paralytic effects were induced, but when locally applied to nerves their functions to this extent of application were destroyed. The local effect on muscles, whether striped or unstriped, is to destroy their excitability.

The topical action upon the eye manifested by contraction is as decided as when the article is introduced into the circulation; and what is extremely interesting, one pupil may be thus contracted by physostigma, while the other is dilated by curara. The explanation of the difference of operation between these two substances is one of great interest. J. C.

ART. XXII.—*Lectures on the Progress of Anatomy and Surgery during the Present Century.* By SIR WILLIAM FERGUSSON, Bart., F. R. S., etc. etc. 8vo. pp. xii. 302. London: John Churchill & Sons, 1867.

THERE are few books from reading which we have derived more pleasure or more profit than from this, by Sir Willian Fergusson. Many of our readers are doubtless already familiar with these lectures, through their publication in the *Lancet* for 1864 and 1865 (from which periodical they are now reprinted), and with the twelfth especially, from its having been republished in the number of the *Medical News and Library* for September of the latter year named.

Since the death of Brodie, Sir Wm. Fergusson may perhaps be justly considered as the representative man of English surgery, and certainly no one can listen to his teachings as embodied in the volume before us, without feeling an ever-growing admiration for his eminent skill and acquirements as a surgeon, as well as for that trait which most adorns (unhappily too rarely) the character of a great surgeon, his sincere and unfeigned modesty, both as a writer and as a man.

These lectures were delivered before the Royal College of Surgeons of England, during the years 1864 and 1865, in the discharge of the author's duties as Professor of Anatomy and Surgery to that body. The first lecture is introductory, and the remainder treat respectively of the following subjects: on conservative surgery, on hare-lip and split-palate, on lithotomy in children and on lithotrity, on excision of the knee (two lectures), on minor surgery, on lithotrity, on lithotomy, operations on the jaws, on amputation, and on operations and practical surgery.

Our readers may easily perceive, from the above summary, the importance and scope of the author's remarks; and we doubt not that they will agree with us, that anything upon these subjects which Sir Wm. Fergusson thinks it worth while to teach, it is certainly worth while for all who practise surgery to attentively heed.

It is a trite remark that there is no surer proof of ignorance or mere superficial information than a pretension to universal knowledge; he that strives to excel in all things will generally fail of eminence in any. On the other hand, the man who honestly confesses his want of skill in certain branches of scientific instruction, may usually be trusted as to his acquirements in those which he does profess to have mastered. Accordingly, we are not at all surprised to meet with the following modest statements of Sir Wm. Fergusson, with regard to the recent advances in certain specialities of modern surgical practice.

"The application of the stethoscope to surgical diagnosis, the exclusive use of the microscope in pathology, the invention of the laryngoscope and its recent application in practice, are all interesting features in modern surgery. The ophthalmoscope, too, is one of the most ingenious and clever inventions for which surgery is indebted, nor can there be a doubt that, in special cases, the speculum is also of vast service. But I must leave it to greater enthusiasts, and those more skilled than myself, to dilate upon the marvels divulged by these instruments, and to fix upon their relative value as additions to the surgery of the present century.

"Ophthalmic surgery has made wonderful strides within our own time; but I do not profess myself competent to dwell on such a theme. It is pleasing to see that those who excel in this department, particularly amongst ourselves, are gentlemen who from their education and competency, are fitted to hold the